Lat 40.78338 Lon -121.37698

Forest Health Protection
Pacific Southwest Region

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To: District Ranger, Hat Creek Ranger District, Lassen National Forest

Subject: Evaluation of the Lost Fire Plantation, Hat Creek Ranger District, Lassen National Forest (FHP Report NE06-04)

At the request of Paul White, Culturist, and Rich Coakley, Silviculturist, from the Hat Creek RD, Danny Cluck and Dave Schultz, Forest Health Protection Entomologists, conducted a field evaluation of the Lost Fire plantation on February 15, 2006. The objective of the visit was to identify insects causing defoliation, leader and shoot dieback and pitch masses on planted Jeffrey pine (*Pinus jeffreyi*) and ponderosa pine (*Pinus ponderosa*) and to provide recommendations as appropriate. Paul White, Rich Coakley, Mary Price, Clarisa Steigner, and James Simmons from the Hat Creek RD accompanied us in the field.

Background

This 4,000 acre plantation is located just east of the Hat Creek Rim near Government Lake on the Hat Creek Ranger District within the perimeter of the Lost Fire that burned 23,000 acres in 1987. The elevation of the site is approximately 4,960 feet and has an extremely sharp precipitation gradient. Precipitation for the portion of the Lost Fire that was not planted averages 15-20 inches per year while the planted acres average around 20-25 inches per year. Western juniper (*Juniperus occidentalis*) was common in the area before the fire. Jeffrey and ponderosa pine were planted from 1988 to 1994 and there are now approximately 350-400 trees per acre averaging 6 inches in diameter and 15 feet in height. The Site Index is 70 (Meyer 1961).

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Observations

Many upper lateral and terminal shoots of sapling and pole size Jeffrey and ponderosa pine in the Lost Fire plantation show signs and symptoms of attack by the western pine shoot borer (*Eucosma sonomana*). These attacks are stunting leader growth or killing leaders and lateral shoots. Attacks have occurred over several years on a few trees resulting in significant growth loss. Many attacked leaders have lost dominance to lateral shoots.

Large pitch masses caused by sequoia pitch moth (*Synanthedon sequoiae*) attacks were observed on several tree boles near the exit holes of western pine shoot borer larvae on the terminal shoot and near branch junctions lower on the bole. Pitch exuding from exit holes of western pine shoot borer larvae at the base of leaders may be attracting sequoia pitch moth adults to a few trees. These attacks do not appear to be causing any branch or leader dieback.

Defoliation of current year needles caused by the pine needle sheathminer (*Zelleria haimbachi*) was observed in the terminal and upper lateral shoots of several trees. Most of the defoliation appears light, affecting less than 25% of the crown. Multiple years of defoliation has caused shoot mortality which has resulted in the upper crowns of a few trees becoming rounded due to the forking of new shoots.

Discussion

Most insect caused injury to pine plantations can be attributed to the growing conditions in the stand. Over stocking, particularly on dry, low production sites, drought, and brush competition are typical factors that predispose trees to attack. There are several insects capable of causing damage to plantation trees. These insect populations and associated injury fluctuate seasonally and often go undetected until they reach high levels. Thinning young plantations and limiting competition from other vegetation will reduce the susceptibility to most regeneration insects.

Only a small portion of the Lost Fire plantation was surveyed for insect injury. Observations of insect injury were made in the Government Lake area and along Forest Service Road 18. Further inspection of the entire plantation would be required to accurately determine the level of injury caused by insects.

Of the three insects that are causing injury to young Jeffrey and ponderosa pine in the Lost Fire plantation the most serious pest is the western pine shoot borer. Injury by this insect can cause an average loss in vertical growth of up to 25% each year a terminal shoot is attacked. Many trees in the Lost Fire plantation show signs of multiple years of shoot borer attacks leading to significant growth loss and in some cases, loss of leader dominance to lateral shoots. Based on the thresholds for treatment developed by Scott and Sower (1994) for western pine shoot borer using mating disruption techniques, only stands with greater than 25 percent of the shoots infested should be considered candidates for control treatment. Depending on resource objectives, treatments may only be economically justified if the stand has at least a 50 percent infestation level (Table 1).

Table 1. Threshold for treatment of western pine shoot borer by mating disruption and estimated levels of protection of ponderosa pine terminal shoots. (Adapted from Scott and Sower 1994)

Percent Infested Shoots Before Treatment	Percent Infested Shoots After Treatment	Comments*
25	5	Probably not worth treating.
26-49	5-10	Improvement in vertical growth 0-10% per year.
50	10	Probably improve vertical growth for plantation by about 10% per year.

*As indicated in the table, mating disruption should probably not be considered unless 26% or more of the terminal shoots are infested. Moreover, in terms of benefits derived, the cost of treatment may only be justified--even for high-value seed orchards--when half or more of the terminals are infested.

Depending on resource objectives for the Lost Fire plantation, District staff might consider developing a treatment threshold based on a cost-benefit analysis of available treatment options. If a threshold exists where controlling western pine shoot borer populations is reasonable, then a ground survey should be conducted to accurately determine the current level of infestation.

Pine needle sheathminer feeding injury is also widespread within the plantation. If a pine needle sheathminer outbreak persists for more than two years, terminals may die and forks may develop in the upper whorls. Forking of the main stem can result in poor tree form and reduced value if the trees are managed for wood fiber production. In forest situations, pine needle sheathminer outbreaks usually subside in 1-2 years and cause little injury. Chemical sprays are available to suppress sheathminer populations; however the cost–benefit ratio of using insecticides in a forest setting may be prohibitive.

Sequoia pitch moth larval feeding activity causes relatively minor injury to trees because they usually do not girdle the trunk. The primary effect of feeding is copious pitch flow, which is mainly an aesthetic concern. On young trees, feeding injury can sometimes cause one or a few limbs to die or cause them to be weakened and susceptible to breakage. Pruning can increase a trees susceptibility to pitch moth attacks because they are attracted to tree wounds. Insecticides have not proven effective in controlling pitch moth attacks. Typically, no control for sequoia pitch moth is necessary in a forest environment.

Information on the biology of each of these insects is provided in Appendix A.

Recommendations

Pre-commercial Thinning

Thinning the Lost Fire plantation will reduce susceptibility to most insect pests but will not completely eliminate the types of insect caused injuries that are currently affecting young Jeffrey and ponderosa pine, especially terminal shoot injury caused by the western pine shoot borer. Western pine shoot borers tend to select those terminals that are more robust and presumably more suitable for larval development. These types of terminals are typically found on the largest and most vigorous plantation trees. Therefore, even though it is recommended to retain the best trees during a pre-commercial thinning, dominant trees may be obscured by western pine shoot borer activity and the treatment may not be as beneficial as expected. Thinning does, however, provide the opportunity to remove severely damaged trees and improve overall health and vigor of the stand. Trees with multiple tops and trees that have had growth severely stunted by insect attacks or because they were not properly planted, such as "J-rooted" trees, should be selected against during any thinning operation.

Direct Control of Western Pine Shoot Borer

If the Lost Fire plantation is exceeding a pre-determined treatment threshold for western pine shoot borer and the resource objective for the stand is adversely affected, there are several treatment options available to suppress western pine shoot borer populations. All options could require treatments over several years until trees reach approximately 25 feet in height. Furthermore, additional surveys would be required to assess efficacy of initial treatments and determine the need for additional treatments.

Mating Disruption: Mating disruption for western pine shoot borer populations is generally accomplished by applying synthetic pheromone-impregnated releasers within the plantation. Hand applied pheromone strips are attached to host trees or pheromone-formulated plastic polymers are aerially distributed over the entire plantation. Treatment with 40-80 strips/acre results in a dose of 5-10 g/acre and has shown good results for mating disruption except where a small treated stand is adjacent to or surrounded by an untreated infested site. The recommended aerial application a rate is 7-9 grams/acre. Regardless of the application method, the cost for the product is approximately $35/acre.

Trap Out: Although not scientifically tested, a trap out strategy of using pheromone baited traps may be an alternative to mating disruption. If the pheromone baits are relatively strong and the males are frequently captured, this could be a successful management strategy to reduce shoot borer populations. Generally more than one year of treatment will be necessary to successfully suppress shoot borer populations. If a trap out strategy is employed, baited sticky traps should be placed in a grid arrangement at 30 foot intervals throughout the affected stand. The cost of enough pheromone baited traps to cover one acre at 30 foot spacing is approximately $406.

Lethal Attractants: Lethal attractants are another option for western pine shoot borer control. This technology uses attractant pheromone and an insecticide called Permethrin combined in a liquid form that is dispensed as a droplet on individual branches. The males are attracted to the droplets and attempt to mate. Any contact with the droplet will either kill or disable the insect, thus preventing mating and subsequent egg deposition by females. Treatments are applied by hand at a rate of 600 droplets/acre. The cost of the product, including dispenser, is approximately $12/acre.

If any of the above treatments are employed, they should extent at least 100 yards beyond the treatment area, if adjacent sites are composed of similar host types, to slow western pine shoot borer re-invasion of the plantation.

If the District is interested in pursuing treatment options for western pine shoot borer, please contact your Forest Health Protection office. Appropriate NEPA documentation would be required when using pesticides or pheromones.

Forest Health Protection can assist in the design and implementation of ground surveys for the three insects causing injury to the Lost Fire plantation. We can also help District staff determine the need for, and the selection of, appropriate control treatments. If you have any questions regarding this report and/or need additional information please contact us at 530-252-6431 or 530-226-2437.

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Literature Referenced

Meyer, W.H. 1961. Yield of even-aged stands of ponderosa pine. USDA Technical Bulletin 630 (revised 1961).

Munson, A.S. and S.L. Smith. 2001. Survey of insect activity in Jeffrey pine plantations on the Carson Ranger District, Humboldt-Toiyabe National Forest. USDA Forest Service, Region 4, Forest Health Protection, Biological Evaluation R4-01-03. 15 p.

Scott, D.W. and L.L. Sower. 1994. Western pine shoot borer monitoring and population reduction guidelines. USDA Forest Service, Region 6, Blue Mountains Pest Management Zone, BMZ-94-09. 12 p.

Appendix A. Insect Biology

Pine Needle Sheathminer (*Zelleria haimbachi*)

Jeffrey and ponderosa pine are the preferred hosts of the pine needle sheathminer. The adults are silvery white with a wingspread of 12 mm. The forewings are light yellow with a white band lengthwise through the center. First instar larvae are elongate and bright orange. Eggs are laid on the current year needles. The first instar larva is the needleminer and spends the winter in that stage. In the spring, the larvae emerge from the needle and migrate to the base of the needle cluster where they feed in the sheath, severing the needles, causing them to droop, die and shed prematurely. There is one generation annually. Trees attacked are usually at least 4 years old. There is generally no effect from defoliation on growth of trees less than ten years old. Trees older than 10 years may experience growth reduction and but rarely mortality.

Sequoia Pitch Moth (*Synanthedon sequoiae*)

The sequoia pitch moth is a clearwinged moth in the Family Sesiidae (Lepidoptera). The adults are black and yellow, resemble a wasp, and are characterised by having narrow wings that tend to be transparent and unscaled (hence the name "clearwinged" moth). The sequoia pitch moth ranges from British Columbia to Idaho, Montana and California. It attacks several species of Pinus, including ponderosa, Jeffrey, lodgepole, Monterey and sugar pine. It also occasionally attacks Douglas-fir but apparently does not feed on Sequoia. It has a two year life cycle. The larvae bore into and feed in the cambium region causing copius pitch masses to form on the bole. Attacks are frequently associated with injuries and at the junctions of the limbs and the bole. It is generally considered an ornamental pest but repeated attacks over several years can cause significant injury, particularly to young, small-diameter, trees. The sequoia pitch moth has been recorded attacking young ponderosa pines pruned to create or maintain fuel breaks. The resulting pitch masses are considered to be somewhat of a fire hazard if prescribed burning is used to maintain the break.

Western Pine Shoot Borer (*Eucosma sonomana*)

The western pine shoot borer is a pest of Jeffrey, ponderosa and lodgepole (*Pinus contorta*) pines throughout the west. The adult, which has coppery-red forewings marked with two bright gray transverse bands and a wingspan of 16 to 22 mm, lays eggs on the elongating shoots in the spring. The larvae bore into the terminal shoots and mine in the pith. Damage can cause an average loss in vertical growth of up to 25% each year a terminal shoot is attacked. Attacked leaders sometimes lose dominance which leads to forking. Laterals that are attacked usually die. It has a single generation a year and adults fly for two to three months during the spring.

Western pine shoot borers tend to select those terminals that are potentially more robust and presumably more suitable for larval development. This selection would have the effect of slowing the development of dominant trees. In terms of forest management, this pattern of infestation may directly affect one expected benefit of pre-commercial thinning: because dominance is obscured by the insect, tree selection in thinning becomes less effective. Mating disruption with synthetic sex attractants and trap and kill methods, using attractant pheromone and insecticides, have shown some promise in reducing the damage caused by this insect.